

Our Ref: 2078

25 February 2016

Clenergy Australia
11/20 Duerdin Street
Clayton VIC 3168



Array Frame Engineering Certificate

Installation of PV-ezRack[®] SolarRoof on Tin and Tile Roof flush installation with ECO-Rails

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of PV-ezRack[®] SolarRoof installation within Australia. The design check has been based on the information in the *PV-ezRack SolarRoof_Code Compliant planning and Installation_Guide AV_V2.5* and schematic drawings of the system components by Clenergy (Xiamen) Technology Co. Ltd., provided by Clenergy Australia.

We find the Installation of PV-ezRack[®] SolarRoof on tin and tile roof to be structurally sufficient for Australian use based on the following conditions:

- Wind Loads to AS/NZ1170.2:2011 Admt 2-2012
- Wind Region A, B, C, D
- Wind Terrain Category 2 & 3
- Wind average recurrence interval of 100 years
- Maximum Building height 20 m
- Max. Solar Panel Dimensions 2000x1000 mm

Refer to attached summary table for interface spacing.

Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



Martin Gamble
Managing Director
MAICD



Mudi Ariyaratna
B.Eng(Civil)(Hons)Monash, M.Eng&Mgt, MIEAust,
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Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **With ECO-Rails** **Within Australia** **Terrain Category 2**

For: Clenergy Australia



Job Number: 2078
Date: 23 August 2016

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ISO 9001:2008 Registered Firm
Certificate No: AU1222

Job No: 2078

Client: Clenergy Australia

Project: PV-ezRack® SolarRoof Interface Spacing Table

Address: Within Australia

Australian Standards

AS 1170. 2011 – Structural Design Actions

Part 0 – General Principles

Part 1 – Permanent imposed and other actions

Part 2 – Wind Actions

Part 3 – Snow and Ice Actions

AS 1252 – High Strength Structural Bolting

AS 3600 – Concrete Structures

AS 4055 – Wind Loads for Housing

AS 4100 – Steel Structures

AS 4600 – Cold-Formed Steel Structures

Wind Terrain Category:

WTC 2

Designed: M.A

Date: Aug-16

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

Job: **2078**
 Date: **Aug-16**

REV J

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ECO (Eco Rail)
 Type of Interface ER-I-01 (Tile Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 2
 Roof Angle (Φ) – 5° - 10°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1265	1635		1131	1587		1060	1535
B	885	1270		794	1135		747	1064
C	568	803		512	722		482	679
D	364	509		329	459		310	432

Roof Angle (Φ) – 10° - 20°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	961	1414		862	1262		810	1182
B	679	984		611	883		575	829
C	440	630		397	567		374	534
D	283	402		256	363		241	342

Roof Angle (Φ) – 20° - 30°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1045	1265		936	1131		879	1060
B	736	885		662	794		623	747
C	476	568		429	512		404	482
D	306	364		276	329		261	310

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

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REV J

Roof Angle (Φ) - 30° - 60°								
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Interme diate	Internal		Interm ediate	Internal		Interme diate	Internal
A	1151	1571		1063	1464		1015	1402
B	886	1237		810	1144		762	1093
C	580	886		522	810		492	761
D	371	570		335	513		316	483

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 Address: **Within Australia**
 Designed: **M.A**

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REV J

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ECO (ECO-Rail)
 Type of Interface ER-I-05 (Tin Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 2
 Roof Angle (Φ) – 5° - 10°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1487	1635		1446	1587		1423	1561
B	1360	1488		1324	1447		1303	1424
C	1217	1327		1186	1292		1169	1273
D	1089	1184		1062	1154		1046	1137

Roof Angle (Φ) – 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1388	1529		1351	1486		1330	1462
B	1273	1397		1240	1359		1221	1338
C	1142	1249		1113	1217		1097	1199
D	1023	1117		993	1088		983	1072

Roof Angle (Φ) – 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1418	1487		1379	1446		1358	1423
B	1299	1360		1265	1324		1246	1303
C	1164	1217		1135	1186		1118	1169
D	1043	1089		1017	1062		1002	1046

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

Job: **2078**
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Roof Angle (Φ) – 30° - 60°								
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Interme diate	Internal		Interm ediate	Internal		Interme diate	Internal
A	1452	1571		1424	1542		1407	1526
B	1360	1479		1330	1450		1310	1434
C	1223	1360		1223	1330		1174	1310
D	1094	1218		1067	1187		1051	1169

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

Job: **2078**
 Date: **Aug-16**

REV J

General Notes				
Note 1	Screws minimum embedment length into timber 35 mm			
Note 2	Recommended screws			
	Metal Purlins/Battens	Fasteners to use		
	0.55 mm – 1.5 mm	M6-11 TPI RoofZips		
	1.9 mm	M6-11 TPI RoofZips OR 12g-14 TPI Tek screws		
	2.4 mm and Above	12g-24 TPI Tek screws		
	Wood purlins and Rafter	Fasteners to use		
	Pine and Hardwood (35mm embedment and above)	M6-11 TPI RoofZips OR 14g-10 TPI		
Note 3	Above Spacing calculated based on 1.9mm steel purlin OR F17 Hardwood For Wind region C & D spacing for Tin Roof should be reduced as follows,			
	Material	Wind Region C		Wind Region D
		Middle	D.W & U.W	Middle D.W & U.W
	0.55 mm steel Batten	22%	25%	30% 42%
	0.75 mm steel Batten	0%	0%	10% 5%
Note 4	Following components are satisfied to use according to AS1170.2011			
	Components	Part Number	Description	
	ECO-Rail	ER-R-ECO	ECO-Rail	
	Corrugated Adapter	ER-AD-C110	Adapter for corrugated iron roof	
	Hanger Bolt	ER-HB-200/WOMP	Hanger Bolt without mounting plate M10x200. Fixed to timber purlin only	
	Roof extender	ER-RE-200	Roof Hook Extender 200mm	
Note 5	Terrain category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstruction per obstructions per hectare.			
Note 6	For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.			
Note 7	For PV panels with length of 1700mm, increase the spacing in the tables by 15%. Do not apply this note with note 8 at the same time.			
Note 8	When using 3 rails, increase the spacing in the tables by 11%. When using 4 rails, increase the spacing in the tables by 19%. Do not apply this note with note 7 at the same time.			
Note 9	For PV panels with length of 1650mm, When using 2 rails, increase the spacing in the tables by 16%. When using 3 rails, increase the spacing in the tables by 19%. When using 4 rails, increase the spacing in the tables by 25%.			



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Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **With ECO-Rails** **Within Australia** **Terrain Category 3**

For: Clenergy Australia



Job Number: 2078
Date: 23 August 2016

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Job No: 2078

Client: Clenergy Australia

Project: PV-ezRack® SolarRoof Interface Spacing Table

Address: Within Australia

Australian Standards

AS 1170. 2011 – Structural Design Actions

Part 0 – General Principles

Part 1 – Permanent imposed and other actions

Part 2 – Wind Actions

Part 3 – Snow and Ice Actions

AS 1252 – High Strength Structural Bolting

AS 3600 – Concrete Structures

AS 4055 – Wind Loads for Housing

AS 4100 – Steel Structures

AS 4600 – Cold-Formed Steel Structures

Wind Terrain Category:

WTC 3

Designed: M.A

Date: Aug-16

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

Job: **2078**
 Date: **Aug-16**

REV J

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ECO (ECO Rail)
 Type of Interface ER-I-01 (Tile Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 3

Roof Angle (Φ) - 5° - 10°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1663	1846		1593	1761		1463	1700
B	1353	1665		1151	1595		1016	1468
C	853	1222		731	1042		649	921
D	539	761		465	654		414	581

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1476	1714		1253	1640		1105	1587
B	1025	1514		877	1285		777	1132
C	655	948		563	812		501	720
D	418	597		361	514		322	458

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1580	1663		1366	1593		1203	1463
B	1115	1353		952	1151		843	1016
C	710	853		610	731		543	649
D	452	539		390	465		348	414

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
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 Designed: **M.A**

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Roof Angle (Φ) -		30° - 60°						
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Intermediate	Internal		Intermediate	Internal		Intermediate	Internal
A	1536	1676		1383	1637		1270	1606
B	1205	1587		1077	1481		984	1363
C	862	1205		746	1076		662	983
D	550	850		474	733		422	651

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 Address: **Within Australia**
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Job: **2078**
 Date: **Aug-16**

REV J

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ECO (ECO Rail)
 Type of Interface ER-I-05 (Tin Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 3

Roof Angle (Φ) - 5° - 10°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1663	1846		1553	1761		1542	1700
B	1512	1665		1452	1595		1408	1543
C	1347	1474		1297	1417		1259	1374
D	1202	1310		1158	1261		1125	1224

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1546	1714		1484	1640		1438	1587
B	1411	1555		1357	1493		1316	1446
C	1261	1384		1215	1331		1180	1292
D	1127	1223		1087	1188		1056	1154

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1580	1663		1516	1593		1469	1542
B	1441	1512		1385	1452		1344	1408
C	1287	1347		1239	1297		1203	1259
D	1149	1202		1108	1158		1077	1125

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
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Roof Angle (Φ) -		30° - 60°						
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Interme diate	Internal		Interme diate	Internal		Interme diate	Internal
A	1570	1648		1520	1621		1489	1606
B	1478	1587		1428	1547		1396	1515
C	1359	1469		1303	1428		1265	1396
D	1214	1346		1163	1297		1130	1259

Client: **Clenergy Australia**
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 Address: **Within Australia**
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Job: **2078**
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 REV J

General Notes				
Note 1	Screws minimum embedment length into timber 35 mm. Holes must be pre drilled.			
Note 2	Recommended screws			
	Metal Purlins/Battens	Fasteners to use		
	0.55 mm - 1.5 mm	M6-11 TPI RoofZips		
	1.9 mm	M6-11 TPI RoofZips OR 12g-14 TPI Teks screws		
	2.4 mm and Above	12g-24 TPI Teks screws		
	Wood purlins and Rafter	Fasteners to use		
	Pine and Hardwood (35mm embedment and above)	M6-11 TPI RoofZips OR 14g-10 TPI		
Note 3	Above Spacing calculated based on 1.9mm steel purlin OR F17 Hardwood For Wind region C & D spacing for Tin Roof should be reduced as follows,			
	Material	Wind Region C		Wind Region D
		Middle	D.W & U.W	Middle D.W & U.W
	0.55 mm steel Batten	22%	25%	30% 42%
	0.75 mm steel Batten	0%	0%	10% 5%
Note 4	Following components are satisfied to use according to AS1170.2011			
	Components	Part Number	Description	
	ECO-Rail	ER-R-ECO	ECO-Rail	
	Corrugated Adapter	ER-AD-C110	Adapter for corrugated iron roof	
	Hanger Bolt	ER-HB-200/WOMP	Hanger Bolt without mounting plate M10x200. Fixed to timber purlin only	
	Roof extender	ER-RE-200	Roof Hook Extender 200mm	
Note 5	Terrain category 3(TC3) refers to numerous closely spaced obstructions having heights generally from 3 m to 10 m. For example suburban housing or light industrial estates. Refer clause 4.2.1 of AS/NZS 1170.2-2011 Amdt 2-2012 for definition of Terrain category 3.			
Note 6	For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.			
Note 7	For PV panels with length of 1700mm, increase the spacing in the tables by 15%. Do not apply this note with note 8 at the same time.			
Note 8	When using 3 rails, increase the spacing in the tables by 11%. When using 4 rails, increase the spacing in the tables by 19%. Do not apply this note with note 7 at the same time.			
Note 9	For PV panels with length of 1650mm, When using 2 rails, increase the spacing in the tables by 16%. When using 3 rails, increase the spacing in the tables by 19%. When using 4 rails, increase the spacing in the tables by 25%.			